	Blacks.		House dust.
Combustible matter	371	..	502
Salts of ammonia	405	..	143
——— potash and soda ...	24	..	20
Oxide of iron	80	..	126
Silica	65	..	144
Alumina	31	..	31
Sulphate of lime	31	..	28
Carbonate of magnesia	2	..	6
	1000		1000

The above substances being held in mechanical suspension in the atmosphere, are those which give to smoke its dense, black, and opaque appearance, and which, by the force of gravity, deposit themselves from the atmosphere in which they have ascended, by being driven up by the draught of the chimney. It is these which deface our buildings, soil the skin and clothes, impede the circulation, both in animal and vegetable bodies, by depositing on the skin or cuticle, and interfering with their natural functional action. They form the soot in our chimneys, by depositing upon the points which they present, and which, were these made round and glazed, would be free from it. That this is the case may be shewn by interposing a layer of wire gauze a short distance above the fire through which the smoke filters, leaving the soot behind, whilst the chimney above is quite clean; the same is shewn in its effect upon the human constitution by the use of one of those ingenious instruments called the respirator. After this has been in use for some time over the mouth, if the particles of wire gauze composing the layers are washed, the water will be shewn to be quite soiled with black particles floating about in it, and which, without the interposition of this simple instrument, would have been taken into the system. We observe the same in the black mucous expectorated from the lungs, as is particularly shewn in a London fog, the black consisting of the soot which has been taken in by the breath. In a November fog, so peculiar to London, the unpleasant feelings which we experience are owing to the denseness of the vapour which is charged with these sooty particles. The action of these mechanical impurities of the atmosphere upon the skin and lungs is more important than is generally considered. That they are the principal source of the injury which smoke inflicts upon vegetation is shewn, that if plants be well washed, and these removed, they will prosper and thrive vigorously, as might be particularly noticed in a garden in the interior of Somerset House a few years since. The skin of animals and cuticle of the surfaces of leaves, when in a natural action, are constantly performing functions which are essential to health, and perfect health cannot be enjoyed whilst these are interrupted. Whatever soils and fills up the pores of the skin is, therefore, injurious, and none can deny that the falling dirt and oily smut which adhere to the skin, in the same proportion or quantity which adheres to any piece of furniture or clothes exposed to the influence of a chimney vomiting forth its volumes of smoke, must have considerable and noxious effect. We have before alluded to the fact of the recession of vegetation from the precincts of our metropolis and large towns. That the great majority of trees and plants cannot live in a smoky atmosphere, and that those which do, never flourish or grow vigorous, in a great measure arises from the surface of the leaves becoming coated with a layer of soot and dirt, thus preventing the acts of respiration or circulation being effectually performed, as the leaves stand in the same relation to plants, and perform analogous functions in them, as the skin and lungs do in animals. Although animals by their motions are different from plants in possessing the power of removing the soot from their bodies, so that this fatal accumulation does not occur, there is no reason to doubt that the effect is equally injurious in proportion to the extent of its existence. This deposit on the wool of sheep is seen in the great contrast amongst the sheep in Smithfield-market, in the clear wool of those from the country as compared with those from the pasturages in the neighbourhood of the metropolis, and equally so in the dark and blackened coats of those pasturing in Hyde-park and Kensington-gardens. The same is noticed in the Regent's-park, and by the degree of colour of the wool, the gardeners employed by the Royal Botanical Society recognise the number of days in which they have been pasturing there. The second injurious effect of carbon is on the lungs, which present an immense extent of surface exposed to the atmosphere, so that any of its impurities will have the same effect upon this as the external surface, thus rendering respiration, an act most essential to life, more or less imperfect. In connection with these remarks it may be stated, that the late C. T. Thackrah, of Leeds, in his work "On the Effects of the Principal Arts, Trades, and Professions on Health and Longevity," enumerates many employments, the gases and odours of which are extremely nauseous and offensive—as tanners, butchers, tallow-makers, &c., and numerous others—but states that scarcely one of these appears to shorten life. On the other hand, almost all the employments in which finely divided particles of solid bodies are inhaled, such as dry-grinders, stone-masons, chimney-sweepers, and others apparently more inoffensive, are ultimately and often rapidly destructive.

3rd. *Carburetted Hydrogen Gas.* — This, which is the common street gas, used for purposes of illumination, is obtained from the destructive distillation of coal, and is that product which produces the chief of the flame in our fires and furnaces. When it escapes unconsumed, it is on account of the incompleteness of the combustion, the requisite combinations not taking place with the oxygen of the atmosphere.

4th. *Carbonic Acid Gas.*—This is formed by the union of the carbon of the coal with the oxygen of the atmosphere. It will not burn, nor support combustion or animal life, but, on the contrary, destroys both. Its uses in nature are various, and united with lime, it forms carbonate of lime, varying in structure from chalk to the finest Carrara marble. Given off extensively by plants during the absence of light, it is re-absorbed by them in the day-time, and forms their aliment. It is spontaneously given off in the decomposition of various vegetable substances, and is found in cellars, or deep wells that have been for some time closed from the atmosphere, and it is therefore unsafe to enter such places, unless the quality of the air has been previously tested, which is done by introducing a lighted candle first. If carbonic acid gas exist in dangerous proportions, the candle will be extinguished, and life would have been destroyed if placed under these circumstances.

5th. *Carbonic Oxide Gas.*—This gas, which is also formed by the union of carbon with oxygen, is the result of imperfect combustion, as were sufficient of the latter to have been admitted into combination, it would have been converted into carbonic acid. It burns with a blue flame, by which its presence may be recognized in lamps and furnaces.

6th. *Nitrogen Gas.*—This is that portion of the air which is irrespirable, and will not support combustion. Along with hydrogen gas it forms ammonia.

7th. *Oxygen Gas.*—Some of this exists in smoke, and will always be found where complete combustion has not taken place.

8th. *Watery Vapour or Steam.* — This is produced chiefly by the union of the hydrogen of the coal with the oxygen of the air, and although of minor consequence, is the result of imperfect combustion.

9th. *Ammonia.*—This is a product of some importance, particularly as the result of imperfect combustion in rooms, or in a limited atmosphere. It is a compound of nitrogen and hydrogen gases, and is formed when the coal is consumed. It is also the result of imperfect combustion, as, if the hydrogen be burnt, ammonia cannot be formed, and we may presume that the nitrogen will make its escape up the chimney alone. Its presence, as the result of combustion, may be recognized in the white powder sublimated at the top of what are erroneously called gas consumers, this being carbonate of ammonia. M. D'Arcet recognized the presence of this gas in the atmosphere of London. It possesses a very powerful action on organic substances.

10th. *Sulphurous Acid Gas.*—That all coals contain sulphurate of iron, or iron pyrites, which consists of sulphur in combination with iron, is well known. Some coals contain so much, that in its decomposition, when exposed to the atmosphere, and the influence of rain, it is apt to ignite spontaneously, from which cause ships and other places have been destroyed. In furnaces, a great proportion combines with iron and other unvolatile parts of the coal; but a considerable quantity more escapes into the atmosphere in union with oxygen, forming sulphurous acid gas. It exerts a very powerful action upon organic substances, and is equally inimical to animal as to vegetable life. It probably exists largely in the atmosphere, and by its chemical action upon vegetables, proves one cause of their destruction. It also exercises a very powerful action upon the fabrics of works of art, by which the choicest productions of the limner are destroyed much sooner than they would be by the hand of time. It also acts powerfully on calcareous and stony substances, and is one cause of the more speedy destruction of statuary, &c. M. Darcet, the celebrated French chemist, confirmed the existence of this gas in the atmosphere, by walking through the streets of London, with prepared test papers for sulphurous acid and ammonia stuck in his hat, and from the rapidity with which they were discoloured, he came to the conclusion that the air was strongly impregnated with the former.

11th. *Sulphurretted Hydrogen Gas.* — This exists in very small proportions, and is formed from the union of the sulphur with part of the hydrogen of the coal. It is this gas which soils and blackens silver and plated articles when exposed to the atmosphere.

12th. *Cyanogen.*— There is reason to believe the existence of this gas in smoke.

Although, from the natural tendency which *gases* have to become diffused, there will be but a very small proportion of these in any given quantity of atmospheric air, too small, indeed, to be recognized by any chemical tests, when it is considered what an immense quantity of this air passes through the lungs of each individual in the space of twenty-four hours, it becomes a matter of important inquiry. By well-conducted experiments, this averages from a million to a million and a half of cubic inches, and small as the quantity may be, it is sufficient to constitute the impurity of the atmosphere as a not unimportant element amongst the causes which deteriorate the health of the inhabitants of large towns. The gases above enumerated are more or less poisonous, and although existing in a quantity not sufficient to destroy animal life, their presence even in minute proportions is very injurious to the animal economy. Carbonic acid gas is speedily fatal, as is shewn in the numerous instances in which persons have injudiciously (or by adopting the fashionable French mode of poisoning) slept in close rooms where charcoal fires have been burning; but as the result of perfect combustion would be to produce this gas in greater quantities, and prevent the formation of various of the other gases referred to, so a very different effect would be produced. Nature has provided a means for its speedy decomposition, as every vegetable is at work, as well as other means are in constant operation, causing its disappearance. It is a natural product, but being injurious to animal life, nature has, with that beauty which is characteristic of all her operations, provided means for its removal, whilst carburetted hydrogen, sulphurous acid gas, and others not being natural products, by the operations of organization, no such means are provided. Were carbonic acid and nitrogen gases the only products of combustion distributed in the atmosphere, the vegetation in and near our towns would not be affected to its present extent, and we might enjoy the luxuries of the field or garden much more than we do now.

In proportion as we approach to perfect combustion, so do we get rid of more or less of these gaseous products, and the vapour becoming more attenuated, is comparatively harmless. The furnace invented by Mr. Juckes* appears to accomplish this important object more perfectly than any other process or arrangement which we have seen, and our observations lead to the following conclusions. The scoriæ ejected by it consists chiefly of aluminous, siliceous, and earthy matters, with sulphur in combination with iron (the proportions of which will always vary according to the quality or nature of the coal employed) with very little carbon, which in large proportions distinguishes *cinders* from *clinkers*, such excess of carbon being the result of imperfect combustion. The difference is very obvious, as is seen in the much greater specific gravity of

* A description of this appeared in No. 3 of THE BUILDER.